

Checklist of the cicadas (Insecta: Hemiptera: Cicadidae) of Costa Rica including new records for fourteen species

Allen F. Sanborn

Barry University, Department of Biology, 11300 NE Second Avenue, Miami Shores, FL 33161-6695, U.S.A.
E-mail: asanborn@barry.edu

ABSTRACT: A current checklist of the Costa Rican cicada fauna is provided. The first Costa Rican records of *Zammara calochroma* Walker, 1858, *Diceroprocta pusilla* Davis, 1942, *Diceroprocta ruatana* (Distant, 1891), *Ollanta modesta* (Distant, 1881), *Pacarina puella* Davis, 1923, *Pacarina schumanni* Distant, 1905, *Majeorona truncata* Goding, 1925, *Procollina medea* (Stål, 1864), *Carineta verna* Distant, 1883, *Carineta viridicollis* (Germar, 1830), *Herrera ancilla* (Stål, 1864), *Calyria cuna* (Walker, 1850), *Selymbria pluvialis* Ramos & Wolda, 1985, and *Conibosa occidentis* (Walker, 1858) are provided. *Diceroprocta digueti* (Distant, 1906) and *D. vitripennis* (Say, 1830) are removed from the Costa Rican cicada fauna. The new records increase the known cicada diversity 45% bringing the total number of cicada species reported in Costa Rica to 45 species in 17 genera representing nine tribes and two subfamilies of the family Cicadidae.

INTRODUCTION

The long history of Costa Rican efforts to catalog and protect the natural diversity in their country has led to much work describing the natural history of Costa Rican species. Scientists investigating cicadas have been a part of these larger efforts. For example, Young (1972; 1973; 1974; 1975; 1976; 1980a; 1980b; 1980c; 1980d; 1981a; 1981b; 1981c; 1982, 1983a; 1983b; 1984; 1991) and Young *et al.* (1973) published a series of papers describing the natural history of cicadas in Costa Rica sometimes without the species being identified beyond the generic level. Even with these efforts, new species of cicadas continue to be recorded (Sanborn 2005; Sanborn *et al.* 2008). Cicadas are often taken during larger, non-specific collection efforts and await determination housed in institutional collections resulting in the known faunal diversity being underrepresented.

My colleagues and I have published several papers over the last dozen years describing the cicada fauna, new species, and providing new records of cicadas in various countries in the New World (Sanborn 2001a; 2001b; 2005; 2006a; 2006b; 2007a; 2007b; 2008; 2009; 2010a; 2010b; 2011a; 2011b; Sanborn *et al.* 2005; 2008; 2011a; 2011b; 2012; Sanborn and Heath 2012; Sanborn and Maes 2012; Maes *et al.* 2012). This series of papers has been produced to provide information on the regional fauna while expanding the information on the biogeography of individual cicada species and to assist with further species determinations. This work is a continuation of these cicada studies describing new records for Costa Rica along with the first complete listing of species currently known for the country.

MATERIALS AND METHODS

Specimens of 14 species representing new records for Costa Rica were found among the undetermined cicadas at the Instituto Nacional de Biodiversidad, Santo Domingo (INBC), Monte L. Bean Life Sciences Museum, Brigham Young University, Provo (BYUC), Louisiana State Arthropod

Museum, Baton Rouge (LSAM), Utah State University, Logan (EMUS), Florida State Collection of Arthropods, Gainesville (FSCA), University of Delaware, Newark (UDCC), Los Angeles County Museum of Natural History, Los Angeles (LACM), University of Minnesota, St. Paul (UMSP), University of Connecticut, Storrs (UCMS), San Diego Natural History Museum, San Diego (SDMC), and Montana State University, Bozeman (MTEC). Voucher specimens for the new records are deposited in the institutions of origin and Sanborn collections (AFSC) as listed with each species. Records for other species inhabiting Costa Rica were determined by searching the cicada bibliographies (Metcalf 1963a, b, c; Duffels and van der Laan 1985) and individual references to Costa Rican cicadas can be found there. Data for geographical distribution of the species were collected from the cicada bibliographies and more recent literature (Wolda 1977; 1988; 1989; 1993; Ramos and Wolda 1985; Wolda and Ramos 1992; Sanborn 2001a; 2005; 2006a; 2006b; 2007a; 2007b; 2010a; 2010b; 2011a; 2011b; Sueur 2002; Sanborn *et al.* 2008; 2012; Goemans 2010; Sanborn and Heath 2012; Sanborn and Maes 2012; Maes *et al.* 2012; Sanborn and Phillips 2013).

RESULTS AND DISCUSSION

The cicada bibliographies provided reference to 27 species inhabiting Costa Rica with an additional four records found in the more recent literature including our descriptions of three new species (Sanborn 2005; Sanborn *et al.* 2008). New records for 14 additional species were found in the undetermined material of the above listed institutions.

List of new records

Zammara calochroma Walker, 1858 (Subfamily Cicadinae, Tribe Zammarini)

Geographical distribution. *Zammara calochroma* has previously been reported from Colombia, Ecuador, Mexico, Panama, and Venezuela (Metcalf 1963a; Wolda and Ramos 1992; Sanborn 2006b; 2007a; 2007b; 2010a; Goemans

2010).

Specimens examined. COSTA RICA, Heredia, La Selva Exp. Station, 17 – VII – 1992, R. Ochoa, black light trap (1 male, BYUC); Zent, 27 – V – 1958, M.J. Stelzer, MS JB-137 (1 male, 1 female, AFSC).

Diceroprocta pusilla Davis, 1942 (Subfamily Cicadinae, Tribe Cryptotympanini, Subtribe Cryptotympanaria)

Geographical distribution. *Diceroprocta pusilla* has previously been reported from Belize, Guatemala, Honduras, and Mexico (Metcalf 1963a; Sanborn 2006a; 2007b; 2010b).

Specimens examined. COSTA RICA, 1968, J.B. Heppner (1 female, AFSC).

Diceroprocta ruatana (Distant, 1891) (Subfamily Cicadinae, Tribe Cryptotympanini, Subtribe Cryptotympanaria)

Geographical distribution. *Diceroprocta ruatana* has previously been reported from Guatemala, Honduras, and Nicaragua (Metcalf 1963a; Sanborn 2006a; 2010b; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Guan., S. Cañas, 24-30 – IV – 1990, F.D. Parker (1 male, EMUS); *ibidem*, 4-6 – V – 1989 (2 males, EMUS, 2 females, AFSC); *ibidem*, 8-15 – V – 1990 (3 males, 4 females, EMUS); *ibidem*, 16-23 – V – 1989 (1 female, EMUS, 2 males, AFSC); Puntarenas Prov., 3 km E of Miramar, 12 – V – 1995, B.O. Huntsman (1 female, BYUC); Prov. Guanacacaste, El Centro Ecológico La Pacífico, 4 – VI – 1989, J.T. McBurney (1 female, BYUC).

Ollanta modesta (Distant, 1881) (Subfamily Cicadinae, Tribe Fidicinini, Subtribe Guyalnina)

Geographical distribution. *Ollanta modesta* has previously been reported from Belize, El Salvador, Guatemala, Honduras, Mexico, and Nicaragua (Metcalf 1963a; Sanborn 2001a; 2006a; 2007b; 2010b; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Guan., S. Cañas, 23-25 – III – 1989, F.D. Parker (6 males, 5 females, EMUS); *ibidem*, 4-6 – V – 1989 (2 males, 2 females, EMUS); *ibidem*, 7-10 – V – 1989 (2 males, 3 females, EMUS, 1 female, AFSC); Guan., 14 km S. Cañas, 1-11 – I – 1990, F.D. Parker (2 males, 1 female, EMUS); *ibidem*, 23-31 – III – 1990 (2 males, 2 females, EMUS); *ibidem*, 1-7 – IV – 1990 (1 male, EMUS); *ibidem*, 28 – IV – 1991 (1 male, 2 females, EMUS, 2 males, 2 females, AFSC); *ibidem*, 15-23 – V – 1990 (1 male, 2 females, EMUS); *ibidem*, 16-23 – V – 1990 (3 males, 6 females, EMUS); San Jose, 4 km N. Brazilito, 5-10 – VI – 1989, F.D. Parker (1 female, EMUS); Guanacacaste Province, Santa Rosa National Park, 2-11 – III – 1980, D.H. Janzen & W. Hallwachs, INB005990 (1 male, INBC); Prov. Guanacacaste, Sect. Palo Verde, 10 m. 4-10 – IV – 1995, E. Navarro, de Luz, LN 259150 388500, #4614, INB004614 (1 male, INBC); Guanacacaste, Ref. Nac. Fauna Silvestre Rafael Lucas Rodriguez, Palo Verde, 10 m, IV – 1991, U. Chavarria, L- N 259000_388400, INB000615 (1 male, INBC); Prov. Guan., P. N. Barra Honda, 3 km NO de Nacaome, 100 m, IV – 1993, M. Reyes, L- N 239000_386000, INB001953 (1 female, INBC); Guanacaste Prov., El Ocotal, 17-26 – V – 1989 (1 male, 1 female, AFSC from SDMC); Guanacaste, Playa Naranja nr. Santa Rosa, 12 – III – 1978, D.S. Verity collector (1 male, 1 female, LACM, 1 male, AFSC); Guanacacaste, La

Pacifica nr. Cañas, 22-26 – V – 1984, E. Riley, D. Rider & D. LeDoux (1 male, AFSC); Guanacacaste Prov., ~Cañas, Finca La Pacifica, E2 / 1967, J.C. Schuster Collector (1 female, AFSC); Guanacacaste Prov., Finca Pinilla, 4 – V – 1995, E.O. Huntsman (2 females, AFSC); Lim., Guapiles, 300 ft., 22 – IV – 1964, SLW (1 female, AFSC).

Pacarina puella Davis, 1923 (Subfamily Cicadinae, Tribe Fidicinini, Subtribe Guyalnina)

Geographical distribution. *Pacarina puella* has previously been reported from Guatemala, Honduras, Mexico, Panama, and the United States (Metcalf 1963a; Duffels and van der Laan 1985; Wolda 1977; 1989; 1993; Wolda and Ramos 1992; Sanborn 2006a; 2007b; 2010b; Sanborn *et al.* 2012; Sanborn and Phillips 2013).

Specimen examined. COSTA RICA, Heredia, 1 km S. Puerto Viejo, 4-5 – IV – 1984, E. Riley, D. Rider & D. LeDoux (1 male, FSCA).

Pacarina schumanni Distant, 1905 (Subfamily Cicadinae, Tribe Fidicinini, Subtribe Guyalnina)

Geographical distribution. *Pacarina schumanni* has previously been reported from Belize, El Salvador, Guatemala, Honduras, Mexico, and Nicaragua (Metcalf 1963a; Sanborn 2001a; 2006a; 2007b; 2010b; Sueur 2002; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Heredia, near Puerto Viejo, La Selva Biological Station 10°25' N, 84°00' W, 179 ft, 27 – II – 2004, C. Barlett coll. (1 female, UDCC); Puntarenas, Estación Biol. Las Alturas, 8°57'00" N, 82°49'48" W, el. 1600, 8 – III – 1993, col. D.E. Hansen (1 female AFSC from UMSP); Puntarenas, Rio Colón in Las Alturas, 8°56'47" N, 82°49'41" W, 18 – III – 1991, el. 1300 m, Holzenthal, Muñoz, Huisman (1 male, AFSC from UMSP); Prov. of Guanacacaste, 6 km S. of La Cruz, Rt. #1, R.E. Woodruff coll., 10 – VI – 1964 (4 males, 1 female, FSCA, 3 male, AFSC); Guanacacaste Prov., Finca La Pacifica, 19 – VI – 1976, D. Habeck (1 female, FSCA); Guanacacaste Prov., Finca Pacifica 5 – VII – 1966 (1 female, FSCA); 1968, J. Heppner (1 male, FSCA); Guanacacaste, La Pacifica nr. Cañas, 22-26 – V – 1984, E. Riley, D. Rider & D. LeDoux (1 male, 1 female, LSAM); Heredia, Est. Biol. La Selva, 50-150 m, 10°26' N, 84°01' W, VIII – 1992, INBio-OET (1 female, BYUC).

Majeorona truncata Goding, 1925 (Subfamily Cicadinae, Tribe Fidicinini, Subtribe Guyalnina)

Geographical distribution. The species has previously been reported from Brazil, Ecuador, Guatemala, Honduras, French Guiana, Nicaragua, and Panama (Metcalf 1963a; Sanborn 2006a; 2008; 2010b; 2011b; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Heredia, nr. Puerto Viejo, La Selva Biol. Sta. 10°25' N, 84°00' W, 179 ft., station grounds, 12 – VIII – 2003, C.R. Bartlett, J. Cryan, J. Urban (1 female, UDCC); *ibidem*, 15 – VIII – 2003 (2 males, UDCC); *ibidem*, 16 – VIII – 2003 (1 male, UDCC, 1 male, 2 females, AFSC); *ibidem*, 17 – VIII – 2003 (2 males, AFSC); Heredia, 1 km S. Pt. Viejo, 4-5 – VI – 1984, E. Riley, D. Rider & D. LeDoux (1 female, LSAM, 1 female AFSC); Heredia, Est. Biol. La Selva, 50-150 m, 10°26' N, 84°01' W, VIII – 1992, INBio-OET (1 male, BYUC).

Procollina medea (Stål, 1864) (Subfamily Cicadettinae, Tribe Dazini)

Geographical distribution. This species has previously been reported only from Mexico (Metcalf 1963c; Sanborn 2007b).

Specimens examined. COSTA RICA, Guanacaste, Parque Nacional Guanacaste, Rio San Josecito, 10°55'19" N, 85°28'12" W, 3-4 – IV – 1987, 960 m, Holzenthal, Hamilton, Heyn (1 male, AFSC from UMSP); Heredia, 3.2 km from end of Tunnel Zurqui, 15 – V – 1988, J.E. O'Donnell (1 female, UCMS); Guanacaste, Macizo Miravalles, Estación Cabro Muco, 1100m, 23-28 – IX – 2003, J.D. Gutiérrez, Tp. De Luz, L_N_299769_411243, #75484, INB075484 (1 male, 1 female, INBC); ibidem, #73494, INB003708285 (1 female, AFSC); ibidem, 26 – III – 3 – IV – 2003, INB073494 (2 females, INBC); ibidem, 19 – III – 2003, B. Hernández, Libre, #73705, INB073705 (1 male, INBC); ibidem, 27 – VI – 2 – VII – 2003, #74549, INB0003739950 (1 male, AFSC); ibidem, #74549, INB074549 (1 male, 4 females, INBC); Guanacaste, Cañas, P.N. Volcán Tenoria, Rio Martirio, La Rejolla, 1000-1100m, 14-15 – VI – 2007, J. A. Azofeifa, M. Campos. Tp. Luz Mercurio. L_N_292650_422850 #91628, INB091628 (3 females, INBC); Guanacaste, Cañas, P.N. Volcán Tenoria, Rio Martirio, La Rejolla, 800-900m, 19 – IV – 2007, A. Azofeifa, M. Campos, Tp. Luz Mercurio, L_N_29650_422850, #91628, INB0004090406 (1 female, AFSC); ibidem, INB0004090412 (1 male, AFSC); Alejuela, P.N. Volcán Tenoria, Sector El Pilón, 700-800m, 20-29 – VI – 2003, J. Azofeifa Zuñiga, Libre, L_N_298212_427913 #73793, INB073793 (1 female, INBC); Alejuela, P.N. Volcán Tenoria, Bijagua, Estación El Pilón, 700m, 21-27 – III – 2005, J. Azofeifa Z., Tp. de Luz, L_N_298212_427913 #80021, INB080021 (1 male, 1 female, INBC); Alejuela, P.N. Volcán Tenoria, Sector El Pilón Guatuso, Valle rio Roble, 800-900m, 17 – VIII – 2004, J. Azofeifa, Tp. de Luz, L_N_297700_425800, #78106, INB078106 (1 male, 1 female, INBC); Guanacaste, Tierras Morenas, Bajo Los Cartagos, R Sn Lorenzo, 1050m, Zona Prot. Tenorio, A.C. Arenal, C. Alvarado, IV – 1991, L_N_281800_427600, INBIO463121 (1 female, AFSC); ibidem, INB000557 (1 female, INBC); ibidem, INB000614 (1 male, 4 females, INBC); Cartago, Grano de Oro, 1120m, Chirripó, Turrialba, V – 1993, P. Campos. L_N_200250_595900, INB002108 (1 female, INBC); ibidem, 8-30 – VII – 1992, INB001349 (1 female, INBC); Guanacaste, Rio San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, 23 – III – 21 – IV – 1992, M. Segura, L_N_287800_427600, INBIO 758748 (1 female, AFSC); ibidem, INBIO 758745 (1 male, AFSC); ibidem, INB001195 (1 male, 1 female, INBC); ibidem, A. Marin, INB001196 (1 male, 3 females, INBC); ibidem, V – 1991, C. Alvarado, INB001204 (1 female, INBC); ibidem, G. Rodriguez, INB001362 (1 female, INBC); ibidem, 8 – III – 26 – IV – 1995, G. Rodriguez, INBIO004488 (1 male, 1 female, INBC); ibidem, X – 1992, G. Rodriguez, INBIO 829793 (1 male, AFSC); Guanacaste, Rio San Lorenzo, Tierras Morenas, 1050m, 11 – I – 8 – III – 1995, G. Rodriguez, INBIO004489 (1 male, INBC); Guanacaste, Rio San Lorenzo, Z.P. Tenorio A.C.A. Tilarán, 1050m, V – 1994, G. Rodriguez, L_N_427600_287800 # 2933, INB002933 (1 female, INBC); Guanacaste, Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Il curso Parataxon., VI – 1990, L_N_323300_375700, INBIO283666 (1 male,

AFSC), ibidem, INB000236 (2 males, INBC); ibidem, III – 1988, INB000025 (1 male, INBC); ibidem, VII – 1988, INB000048 (1 male, INBC); Puntarenas, Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300m, VI – VII – 1990, J.C. Saborio, INB000341 (1 female, INBC); Guanacaste, Est. Las Pailas, P.N. Rincón de la Vieja, 17-23 – VII – 1993, K. Taylor, L_N_306300_388600 #2238, INB002238 (1 female, INBC); ibidem, 13-19 – IX – 1993, INB002348 (1 male, INBC); Guanacaste, Sector Las Pailas, P.N. Guanacaste, A.C. Guanacaste, 800m, 6-26 – VI – 1994, K. Taylor, L_N_309500_389500 # 3063, INB003063 (1 female, INBC); Alajuela, 2 km N Colonia Blanca, 800m, P.N. Rincon del la Vieja, 13-28 – VI – 1992, Parataxon, L_N_308800_397800, INB001275 (1 female, INBC); Alajuela, R.V.S. Bosque Alegre, Borde Laguna Hule, 700-800m, 23 – I – 2007, J. A. Azofeifa. Tp. Luz. L_N_253100_512800 #90452, INB090452 (1 female, INBC); Puntarenas, San Vito, Las Cruces, 20 – XI – 1988, A. Solis, INB003652 (1 female, INBC); Alejuela, P.N. Volcán Tenoria, Valle Rio Buenavista, Teñideros, 800-900m, 19 – IV – 2007, J. A. Azofeifa. Tp. Luz. L_N_297843_427210 #91080, INB091080 (3 males, 2 females, INBC); Guanacaste, Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, VI – 1990, A. Guadamuz, D. Garcia, INB000654 (1 male, INBC); Alajuela, P.N. Volcán Lenorio, Estación El Pilón, circa del puesto, 830-900m, 8 – IX – 2004, B. Gamboa, Tp. Luz, L_N_297100_428543 #78070, INB078070 (2 males, INBC); Guanacaste, La Cruz, A.C.G. Pque Nal Gte, Est Mengo, Ladera SW del Volcán Cacao, 1100m, 26 – VI – 1987, Janzen & Hallwachs 85°28'10" W, 10°55'43" N INB003505 (1 female, INBC); Prov. Guanacaste, La Cruz, A.C.G, Pque Nal Gte, Est Mengo, Ladera S W del Volcán Cacao, 1100m, 26 – VI – 1987, D.H. Janzen, Manual L_N_330200_375700 #52580, INB052580 (1 male, INBC).

Carineta verna Distant, 1883 (Subfamily Cicadettinae, Tribe Carinetini)

Geographical distribution. This species has previously been reported only from Panama (Metcalf 1963c; Wolda and Ramos 1992).

Specimens examined. COSTA RICA, San Jose, Escazu, 3/16 – VII – 1998, F.D. Parker (1 female, EMUS); ibidem, 17-26 – VII – 1988 (1 female, EMUS); ibidem, 22 – VII – 5 – VIII – 1989 (2 females, EMUS); ibidem, 5-19 – VIII – 1989 (2 females, EMUS); Guan., S. Cañas Exp. Sta., 9-16 – VIII – 1988, F.D. Parker (1 female, EMUS); Guan., 14 km S. Cañas, 21-27 – VIII – 1989, F.D. Parker (2 males, AFSC); San Pedro, San Jose, 7 – VIII – 1956, L.C. Kuitier coll. (1 male FSCA, 1 male, AFSC).

Carineta viridicollis (Germar, 1830) (Subfamily Cicadettinae, Tribe Carinetini)

Geographical distribution. *Carineta viridicollis* has previously been reported from Bolivia, Brazil, Colombia, French Guiana, Paraguay, and Venezuela (Metcalf 1963c; Duffels and van der Laan 1985; Wolda and Ramos 1992; Sanborn 2007a; 2010a; 2011a; 2011b).

Specimens examined. COSTA RICA, Cartago, Turrialba (CATIE), 22-23 – V – 1984, R.L Penrose, F.T. Hovore & P.H. Sullivan (1 male, LACM); Cartago Prov., Turrialba, 27-29 – V – 1976, D.G. Marqus, coll. (1 male, LACM).

Herrera ancilla (Stål, 1864) (Subfamily Cicadettinae, Tribe Carinetini)

Geographical distribution. *Herrera ancilla* has previously been reported from Belize, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama (Metcalf 1963c; Wolda and Ramos 1992; Sanborn 2001a; 2006a; 2007b; Sueur 2002; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Heredia, near Puerto Viejo, La Selva Biological Station 10°25' N, 84°00' W, 179 ft, 16 – VIII – 2003, C.R. Bartlett, J. Cryan, J. Urban (2 males, UDCC, 1 male, AFSC); ibidem, 18-19 – VIII – 2003 (1 female, UDCC); ibidem, 20 – VIII – 2003 (1 male, UDCC); Heredia, Estación El Ceibo, 10 km SE La Virgen, 10°20' N, 84°05' W, elev. 450-550 m, 8 – IV – 2003, S.M. Clark coll. (1 female, BYUC); Catie, 27 – VI – 5 – VII – 1984, H.L. Dozier coll. (1 female, FSCA); Prov. of Cartago, Turrialba, 14 – VIII – 1968, D.H. Habeck (1 female, FSCA); Prov. of Puntarenas, Palmer Sur, United Fruit Co., 5 – VIII – 1964, R.E. Woodruff, Blacklight trap (1 female, FSCA, 1 male AFSC); Heredia, La Selva Biological Station, 2 km S. Pt. Viejo, 3-5 – VI – 1984, Riley, Rider & LeDoux (1 male, LSAM, 1 male AFSC); Alajuela Province, Alajuela 12 – VIII – 1968, D.H. Habeck, sweeping (1 female AFSC).

Calyria cuna (Walker, 1850) (Subfamily Cicadettinae, Tribe Parnisini)

Geographical distribution. *Calyria cuna* has previously been reported from Brazil (Metcalf 1963c).

Specimens examined. COSTA RICA, Alajuela Province, Est. Biol. Alberto Brenes, 10°13'02" N, 84°35'51" W, 26 – VI – 6 – VII – 1999, 850 m, M.A. Ivie coll. (1 female, MTEC, 1 male AFSC).

Selymbria pluvialis Ramos & Wolda, 1985 (Subfamily Cicadettinae, Tribe Taphurini)

Geographical distribution. *Selymbria pluvialis* has previously been reported from Guatemala and Panama (Ramos and Wolda 1985; Wolda 1988; 1989; Wolda and Ramos 1992; Sanborn 2010b).

Specimens examined. COSTA RICA, Heredia, nr Puerto Viejo, La Selva Biol. Sta., 10°25' N, 84°00' W, 179 ft, 16 – VIII – 2003, C.R. Bartlett, J. Cryan, J. Urban (1 female, UDCC); ibidem, 18-19 – VIII – 2003 (1 female AFSC); Heredia, La Selva Biological Station, 2 km S. Pt. Viejo, 3-5 – VI – 1984 (1 male, LSAM); Catie, 27 – VI – 5 – VII – 1984, H.L. Dozier coll. (1 female, FSCA).

Conibosa occidentis (Walker, 1858) (Subfamily Cicadettinae, Tribe Chlorocystini)

Geographical distribution. *Conibosa occidentis* has previously been reported from Honduras, Mexico, Nicaragua, and Panama (Metcalf 1963c; Wolda and Ramos 1992; Sanborn 2007b; 2010b; Sanborn and Maes 2012; Maes *et al.* 2012).

Specimens examined. COSTA RICA, Heredia, nr Puerto Viejo, La Selva Biol. Sta., Biological Station 10°25' N, 84°00' W, 179 ft, 28 – II – 2004, C.R. Bartlett, J. Cryan, J. Urban (1 female, UDCC).

The new records bring the reported cicada fauna of Costa Rica to 45 species in 17 genera from nine tribes and two subfamilies of the family Cicadidae. The current list of species and their taxonomic position is provided in Table 1. Some of these records filled in a gap in the given species distribution joining previous records from north and south of Costa Rica (*e.g.*, *Majeorona truncata* and *Selymbria pluvialis*). Others represent a southern (*e.g.*, *Pacarina schumanni* and *Procollina medea*) or northern (*e.g.*, *Carineta verna* and *C. viridicollis*) expansion of the known range of a species. Only the recently described *Fidicinoides coffea*, *F. guayabana*, and *F. variegata* and the insular *Proarna cocosensis* are endemic (6.7%). The fauna is composed of a mixture of Central American genera with additions from genera that are primarily distributed in North or South America resulting in an increased overall diversity.

The record of *Diceroprocta digueti* (Distant, 1906) was questionably and mistakenly reported from Costa Rica by Metcalf (1963a). Checking the original reference (Davis 1938) shows that the specimen was from Mexico and not from Costa Rica. The distribution of *D. digueti* is more northern being restricted to Mexico (Sanborn 2007b). The same is true with respect to the record for *D. vitripennis* (Say, 1830), a species restricted to the United States (Sanborn and Heath 2012; Sanborn and Phillips 2013). Distant (1906; 1912) mistakenly synonymized the Central American *Tibicen nigriventris* (Walker, 1858) with *D. vitripennis* in his keys. There has also been an undetermined species identified as *Conibosa* sp. 'D' reported from Costa Rica (Ramos and Wolda, 1985). It is unclear if this refers to an undetermined species (potentially *C. occidentis* reported here) or a new species that requires a description.

The efforts to inventory the cicada fauna of Costa Rica have resulted in the most diverse known fauna in Central America. But, additional species will undoubtedly be added to the cicada fauna of Costa Rica. For example, the potential to extend the range of additional species into Costa Rica from neighboring countries still exists. There are currently four species known to inhabit Nicaragua and 15 species known to inhabit Panama that have not been recorded in Costa Rica and their distributions may eventually be shown to extend across the borders. In addition, I have identified several new species from undetermined material that will increase the known diversity further. This paper provides a summary for those interested in analyzing the Costa Rican cicada fauna.

TABLE 1. Taxonomic list of cicadas currently reported to inhabit Costa Rica. The reported distribution for each species is provided. Specific references to individual countries can be found in the cicada catalogues (Metcalf 1963a; 1963b; 1963c; Duffels and van der Laan 1985; Sanborn 2013). The countries are listed from north to south for each species distribution. AN = Antilles, AR = Argentina, BE = Belize, BO = Bolivia, BR = Brazil, CO = Colombia, CR = Costa Rica, CU = Cuba, EC = Ecuador, ES = El Salvador, FG = French Guiana, GU = Guatemala, GY = Guyana, HO = Honduras, JA = Jamaica, MX = Mexico, NI = Nicaragua, PA = Panama, PE = Peru, PR = Paraguay, SU = Suriname, TT= Trinidad and Tobago, UR = Uruguay, US = United States of America, VE = Venezuela, WI = West Indies.

Family Cicadidae Latrielle, 1802
Subfamily Cicadinae Latrielle, 1802
Tribe Zammarini Distant, 1905
<i>Zammara</i> Amyot and Audinet-Serville, 1843
<i>Zammara calochroma</i> Walker, 1858 – MX, CR, PA, CO, VE, EC
<i>Zammara smaragdina</i> Walker, 1850– MX, GU, HO, NI, CR, PA, CO, VE, BR, EC
<i>Zammara smaragdula</i> Walker, 1858 – MX, GU, CR, PA, CO, BR
<i>Zammara tympanum</i> (Fabricius, 1803) – BE, GU, HO, CR, CO, BR, PE, PR, AR
Tribe Cryptotympanini Handlirsch, 1925
Sub-tribe Cryptotympanaria Handlirsch, 1925
<i>Diceroprocta</i> Stål, 1870
<i>Diceroprocta bicosta</i> (Walker, 1850) – MX, HO, ES, NI, CR, CO
<i>Diceroprocta pusilla</i> Davis, 1942 – MX, BE, GU, HO, CR
<i>Diceroprocta ruatana</i> (Distant, 1891) – GU, HO, NI, CR
<i>Tibicen</i> Berthold, 1827
<i>Tibicen nigriventris</i> (Walker, 1858) – MX, CR, PA
Tribe Fidicinini Distant, 1905
Sub-tribe Fidicinina Distant, 1905
<i>Fidicina</i> Amyot and Audinet-Serville, 1843
<i>Fidicina ethelae</i> (Goding, 1925) – CR, PA, CO, VE, BR, EC, PE
<i>Fidicina mannifera</i> (Fabricius, 1803) – NI, CR, PA, CO, AN, GY, SU, FG, BR, EC, PE, BO, PR
<i>Fidicinoides</i> Boulard and Martinelli, 1996
<i>Fidicinoides cachla</i> (Distant, 1899) – HO, NI, CR
<i>Fidicinoides coffea</i> Sanborn, Moore & Young, 2008 – CR
<i>Fidicinoides fumea</i> (Distant, 1883) – CR, PA
<i>Fidicinoides guayabana</i> Sanborn, Moore & Young, 2008 – CR
<i>Fidicinoides pronoe</i> (Walker, 1850) – MX, GU, HO, ES, NI, CR, PA, CO, VE, TT, BR, EC, PE
<i>Fidicinoides sericans</i> (Stål, 1854) – CR, BR
<i>Fidicinoides spinicosta</i> (Walker, 1850) – NI. CR, PA, CO, BR
<i>Fidicinoides variegata</i> (Sanborn, 2005) – CR
Sub-tribe Gualnina Boulard and Martinelli, 1996
<i>Proarna</i> Stål, 1864
<i>Proarna cocosensis</i> Davis, 1935 – CR
<i>Proarna insignis</i> Distant, 1881 – MX, GU, HO, NI, CR, PA, CO, VE, FG, BR, EC, PE, AR
<i>Proarna invaria</i> (Walker, 1850) – HO, CR, CO, VE, AN, GY, FG, BR, PE
<i>Proarna olivieri</i> Metcalf, 1963 – MX, GU, CR, CO, VE, CU, JA, TT, GY, SU, FG, BR
<i>Proarna sallaei</i> Stål, 1864 – MX, HO, NI, CR, PA, CO
<i>Dorisiana</i> Metcalf, 1952
<i>Dorisiana amoena</i> (Distant, 1899) – GU, CR, PA
<i>Dorisiana semilata</i> (Walker, 1850) – CR, PA, CO, VE, AN, TT, GY, SU, FG, BR, EC, PR, UR, AR
<i>Ollanta</i> Distant, 1905
<i>Ollanta modesta</i> (Distant, 1881) – MX, BE, GU, HO, ES, NI, CR
<i>Pacarina</i> Distant, 1905
<i>Pacarina championi</i> (Distant, 1881) – MX, BE, GU, HO, ES, NI, CR, PA
<i>Pacarina puella</i> Davis, 1923 – US, MX, GU, HO, CR, PA
<i>Pacarina schumanni</i> Distant, 1905 – MX, BE, GU, HO, ES, NI, CR
<i>Majeorona</i> Distant, 1905
<i>Majeorona bovilla</i> Distant, 1905 – CR, CO, BR, FG, PE
<i>Majeorona truncata</i> Goding, 1925 – GU, HO, NI, CR, PA, BR, EC, FG
Tribe Hyantiini Distant, 1905
<i>Quesada</i> Distant, 1905
<i>Quesada gigas</i> (Olivier, 1790) – US, MX, BE, GU, HO, ES, NI, CR, PA, CO, VE, TT, AN, WI, GY, FG, BR, EC, PE, BO, PR, UR, AR
Subfamily Cicadettinae Buckton, 1889
Tribe Dazini Kato, 1932
<i>Procollina</i> Metcalf, 1963
<i>Procollina biolleyi</i> (Distant, 1903) – CR, PA
<i>Procollina medea</i> (Stål, 1864) – MX, CR

TABLE 1. CONTINUED.

Tribe Carinetini Distant, 1905
Carineta Amyot and Audinet-Serville, 1843
Carineta cinara Distant, 1883 – GU, NI, CR, PA
Carineta indecora (Walker, 1858) – GU, CR, PA, CO
Carineta postica Walker, 1858 – GU, NI, CR, PA, CO, EC, PE
Carineta trivittata Walker, 1858 – MX, GU, HO, CR, PA, CO, BR, GY, EC, PE, BO
Carineta verna Distant, 1883 – CR, PA
Carineta viridicollis (Germar, 1830) – CR, CO, VE, BR, FG, BO, PR
Herrera Distant, 1905
Herrera ancilla (Stål, 1864) – MX, BE, GU, HO, ES, NI, CR, PA
Tribe Parnisini Distant, 1905
Calyria Stål, 1862
Calyria cuna (Walker, 1850) – CR, BR
Calyria telifera (Walker, 1858) – CR, HO, NI, VE, BR, PE
Tribe Taphurini Distant, 1905
Sub-tribe Taphurina Distant, 1905
Selymbria Stål, 1861
Selymbria pluvialis Ramos & Wolda, 1985 – GU, CR, PA
Tribe Chlorocystini Distant, 1905
Conibosa Distant, 1905
Conibosa occidentis (Walker, 1858) – MX, HO, NI, CR, PA

ACKNOWLEDGMENTS: The following assisted with access to collections and/or specimens: C. Bartlett (UDCC), R. Baumann and S. Clark (BYUC), C. Carlton and V. Bayless (LSAM), P. Cato and P. Beller (SDMC), P. Clausen (UMSP), S. Halbert, T. Dickens, and J. Brambila (FSCA), W. Hanson and E. Sadler (EMUS), R. Hurley and M. Ivie (MTEC), J. Lewis (INBC), J. O'Donnell (UCMS), and W. Xie (LACM). An anonymous reviewer made suggestions to improve the manuscript.

LITERATURE CITED

Davis, W.T. 1938. New North American cicadas with notes on described species. *Journal of the New York Entomological Society* 46: 291–310.

Distant, W.L. 1906. *A synonymic catalogue of Homoptera. Part I. Cicadidae*. Trustees of the British Musuem, London. 207 pp.

Distant, W.L. 1912. Homoptera Fam. Cicadidae, Subfam. Cicadinae. *Genera Insectorum* 142: 1–64.

Duffels, J.P. and P.A. van der Laan. 1985. *Catalogue of the Cicadoidea (Homoptera, Auchenorrhyncha) 1956-1980*. Dordrect: Dr. W. Junk Publishers. 414 pp. (Series Entomologica: 34).

Goemans, G. 2010. A historical overview of the classification of the Neotropical tribe Zammarini (Hemiptera, Cicadidae) with a key to the genera. *ZooKeys* 43: 1–13.

Maes, J.-M., M. Moulds and A.F. Sanborn. 2012. Cicadidae (Homoptera) de Nicaragua: catálogo ilustrado, incluyendo especies exóticas del Museo Entomológico de León. *Revista Nicaragüense Entomología* 72 (Suplemento 2): 1–138.

Metcalf, Z.P. 1963a. General catalogue of the Homoptera, Fascicle VIII. Cicadoidea. Part 1. Cicadidae. Section I. Tibiceninae. *North Carolina State College Contribution* 1502: i–vii, 1–585.

Metcalf, Z.P. 1963b. General catalogue of the Homoptera, Fascicle VIII. Cicadoidea. Part 1. Cicadidae. Section II. Gaeninae and Cicadinae. *North Carolina State College Contribution* 1502: 587–919.

Metcalf, Z.P. 1963c. General catalogue of the Homoptera, Fascicle VIII. Cicadoidea. Part 2. Tibicinidae. *North Carolina State College Contribution* 1564: i–vi, 1–492.

Ramos, J.A. and H. Wolda. 1985. Description and distribution of two new species of *Selymbria* from Panama (Homoptera, Cicadoidea, Tibicinidae). *Caribbean Journal of Science* 21: 177–185.

Sanborn, A.F. 2001a. A first contribution to a knowledge of the cicada fauna of El Salvador (Homoptera: Cicadoidea). *Florida Entomologist* 84(3): 449–450.

Sanborn, A.F. 2001b. Distribution of the cicadas (Homoptera: Cicadidae) of the Bahamas. *Florida Entomologist* 84(4): 651–652.

Sanborn, A.F. 2005. *Fidicina variegata*, a new cicada species from Costa Rica (Hemiptera: Cicadomorpha: Cicadidae). *Annals of the Entomological Society of America* 98(2): 187–190.

Sanborn, A.F. 2006a. New records for the cicada fauna from four Central American countries (Hemiptera: Cicadoidea: Cicadidae). *Florida Entomologist* 89(1): 75–79.

Sanborn, A.F. 2006b. New records of cicadas from Mexico (Hemiptera: Cicadoidea: Cicadidae). *Southwestern Naturalist* 51(2): 255–257.

Sanborn, A.F. 2007a. Additions to the cicada fauna of Venezuela with the

description of a new species and checklist of the Venezuelan cicada fauna (Hemiptera: Cicadoidea: Cicadidae). *Zootaxa* 1503: 21–32.

Sanborn, A.F. 2007b. New species, new records and checklist of cicadas from Mexico (Hemiptera: Cicadoidea: Cicadidae). *Zootaxa* 1651: 1–42.

Sanborn, A.F. 2008. New records of Brazilian cicadas including the description of a new species (Hemiptera: Cicadoidea, Cicadidae). *Neotropical Entomology* 37(6): 685–690.

Sanborn, A.F. 2009. Checklist, new species and key to the cicadas of Cuba (Hemiptera: Cicadoidea: Cicadidae). *Mitteilungen aus dem Museum für Naturkunde in Berlin – Deutsche Entomologische Zeitschrift* 59(1): 85–92.

Sanborn, A.F. 2010a. The cicadas of Colombia including new records and the description of a new species (Hemiptera: Cicadidae). *Journal of Natural History* 44(25–28): 1577–1607.

Sanborn, A.F. 2010b. New records and new species of Central American cicadas (Hemiptera: Cicadoidea: Cicadidae). *Studies on Neotropical Fauna and Environment* 45(2): 67–76.

Sanborn, A.F. 2011a. Checklist of cicadas (Insecta: Hemiptera: Cicadidae) from Paraguay including new records for six species. *Check List* 7(4): 465–467.

Sanborn, A.F. 2011b. Checklist of the cicadas of French Guiana including new records and the description of nine new species (Insecta, Hemiptera, Cicadoidea, Cicadidae). *Zoosystema* 33(3): 377–418.

Sanborn, A.F. 2013. *Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha). With Contributions to the bibliography by Martin H. Villet*. Academic Press, Elsevier Inc., San Diego. 1002p.

Sanborn, A.F. and M.S. Heath. 2012. Catalogue of the cicadas (Hemiptera: Cicadoidea: Cicadidae) of continental North America North of Mexico. *Thomas Say Publications in Entomology: Monographs*. Entomological Society of America, Lanham, MD. 227pp.

Sanborn, A.F., M.S. Heath, P.K. Phillips and J.E. Heath. 2011a. A new species of the genus *Beameria* (Hemiptera: Cicadidae) from North America. *Journal of Natural History* 45(25–26): 1589–1605.

Sanborn, A.F., M.S. Heath, P.K. Phillips and J.E. Heath. 2011b. The genus *Cacama* Distant, 1904 (Hemiptera: Cicadidae) with the description of three new species. *Zootaxa* 2897: 35–50.

Sanborn, A.F., M.S. Heath, P.K. Phillips and J.E. Heath. 2012. The genus *Pacarina* Distant, 1905 (Hemiptera: Cicadidae) with the description of a new species. *Journal of Natural History* 46(15–16): 923–941.

Sanborn, A.F., M.S. Heath, J. Sueur and P.K. Phillips. 2005. The genus *Neocicada* Kato, 1925 (Hemiptera: Cicadomorpha: Cicadidae), with descriptions of three new species. *Systematic Entomology* 30(2): 191–207.

Sanborn, A.F. and J.-M. Maes. 2012. Checklist of the cicadas (Insecta: Hemiptera: Cicadidae) of Nicaragua including new records for seventeen species. *Check List* 8(3): 437–442.

Sanborn, A.F., T.E. Moore and A.M. Young. 2008. Two new cicada species from Costa Rica (Hemiptera: Cicadomorpha: Cicadidae) with a key to *Fidicinoides* in Costa Rica. *Zootaxa* 1846: 1–20.

Sanborn, A.F. and P.K. Phillips. 2013. Biogeography of the cicadas

- (Hemiptera: Cicadidae) of North America north of Mexico. *Diversity* 5(2): 166–239.
- Sueur, J. 2002. Cicada acoustic communication: potential sound partitioning in a multispecies community from Mexico (Hemiptera: Cicadomorpha: Cicadidae). *Biological Journal of the Linnean Society* 75: 379–394.
- Wolda, H. 1977. Fluctuations in abundance of some Homoptera in a neotropical forest. *Geo-Eco-Trop* 3: 229–257.
- Wolda, H. 1988. Insect seasonality: Why? *Annual Review of Ecology and Systematics* 19: 1–18.
- Wolda, H. 1989. Seasonal cues in tropical organisms: Rainfall? Not necessarily. *Oecologia (Berlin)* 80: 437–442.
- Wolda, H. 1993. Diel and seasonal patterns of mating calls in some neotropical cicadas. Acoustic interference? *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen. Biological, Chemical, Geological, Physical and Medical Sciences* 96: 369–381.
- Wolda, H. and J.A. Ramos. 1992. Cicadas in Panama, their distribution, seasonality and diversity; p. 271–279 in: D. Quintero and A. Aiello (eds.). *The insects of Panama and Mesoamerica. Selected Studies*. New York: Oxford University Press.
- Young, A.M. 1972. Cicada ecology in a Costa Rican tropical rain forest. *Biotropica* 4: 152–159.
- Young, A.M. 1973. Cicada populations on palms in tropical rain forest. *Principes* 17: 3–9.
- Young, A.M. 1974. The population biology of neotropical cicadas. III. Behavioral natural history of *Pacarina* in Costa Rican grasslands. *Entomological News* 85: 239–256.
- Young, A.M. 1975. The population biology of neotropical cicadas. I. Emergence of *Procollina* and *Carineta* in a mountain forest. *Biotropica* 7: 248–258.
- Young, A.M. 1976. Notes on the faunistic complexity of cicadas (Homoptera: Cicadidae) in Northern Costa Rica. *Revista de Biología Tropical* 24: 267–279.
- Young, A.M. 1980a. Observations on the aggregation of adult cicadas (Homoptera: Cicadidae) in tropical forests. *Canadian Journal of Zoology* 58: 711–722.
- Young, A.M. 1980b. Environmental partitioning in lowland tropical rain forest cicadas. *Journal of the New York Entomological Society* 88: 86–101.
- Young, A.M. 1980c. Habitat and seasonal relationships of some cicadas (Homoptera: Cicadidae) in central Costa Rica. *American Midland Naturalist* 103: 155–166.
- Young, A.M. 1980d. Seasonal adult emergences of cicadas (Homoptera: Cicadidae) in northwestern Costa Rica. *Milwaukee Public Museum Contributions in Biology and Geology* 40: 1–29.
- Young, A.M. 1981a. Notes on seasonality and habitat associations of tropical cicadas (Homoptera: Cicadidae) in premontane and montane tropical moist forest in Costa Rica. *Journal of the New York Entomological Society* 89: 123–142.
- Young, A.M. 1981b. Notes on the population ecology of cicadas (Homoptera: Cicadidae) in the Cuesta Angel forest ravine of northeastern Costa Rica. *Psyche* 88: 175–195.
- Young, A.M. 1981c. Temporal selection for communicatory optimization: The dawn-chorus as an adaptation in tropical cicadas. *American Naturalist* 117: 826–829.
- Young, A.M. 1982. Population biology of tropical insects. Plenum Press, New York. 511 pp.
- Young, A.M. 1983a. *Fidicina mannifera* (Chicharra, Sundown cicada). Pages 724–726 in: D.H. Janzen (ed.). *Costa Rican natural history*. Chicago: University of Chicago Press.
- Young, A.M. 1983b. Ecological studies of tropical cicadas. *Field Museum of Natural History Bulletin* 54: 20–25.
- Young, A.M. 1984. On the evolution of cicada x host-tree associations in Central America. *Acta Biotheoretica* 33: 163–198.
- Young, A.M. 1991. Sarapiquí chronicles: A naturalist in Costa Rica. Smithsonian Institution Press, Washington. 361 pp.
- Young, A.M., D. Tyrrel and D.M. MacLeod. 1973. *Entomophthora echinospora* (Phycomycetes: Entomophthoraceae), a fungus pathogenic on the neotropical cicada, *Procillina biolleyi* (Homoptera: Cicadidae). *Journal of Invertebrate Pathology* 21: 87–90.

RECEIVED: July 2013

ACCEPTED: March 2014

PUBLISHED ONLINE: May 2014

EDITORIAL RESPONSIBILITY: Livia Aguiar Coelho